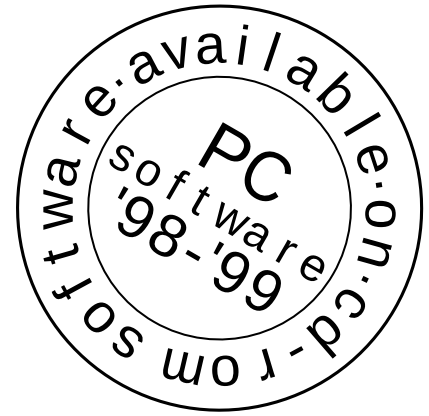


New software to simulate logic circuits seems to hit the streets every month, and most of you will be aware that logic simulation on a PC is a good alternative to wiring up prototypes of digital circuits.

By J.P. Strzalka



Logic Simulator 2.0

First prize, France



The logic simulation program 'Simulat 2.0' was awarded the First National Prize for Competition entries sent to our French editorial department. The program is aimed at students, teachers and hobbyists wishing to widen their knowledge of sequential and combinatory logic circuit design.

Simulat 2.0 allows you to draw schematics of logic circuits in a window displayed on your PC monitor. Once you think the schematic is complete, you launch a simulation run using virtual switches, displays or other indicators and devices to control and visualize the way the logic circuit operates (or not!). Simulat 2.0 is capable of handling four schematics at a time.

Program installation

The program is easy to install under the Windows 95 operating system.

Select 'Run' from the Start menu, type 'X:\setup', and then press the Return key, where 'X:' is the letter of the drive station that has the 'setup' file. Alternatively, use the 'Browse' option to get assistance from Windows 95 in looking for the setup program. If you use the Elektor CD-ROM which contains the present project, navigate to the subdirectory /F/01 where you will find setup.exe.

The installation program builds a group of three programs. The group is called 'Simulat', and it will contain three icons. The first icon in the group

allows you to actually launch Simulat. To do so, double-click on this icon with the left-hand mouse button. In this way you start the simulator program.

Schematic capture

The program enables you to create circuit diagrams. For this function it offers a number of tools that allow users to include elementary logic elements like gates, flip-flops, adders, multiplexers, demultiplexers, timers or counters in your schematic. A rather complex example of such a circuit is shown by the screendump in **Figure 1**. This is actually a counter circuit.

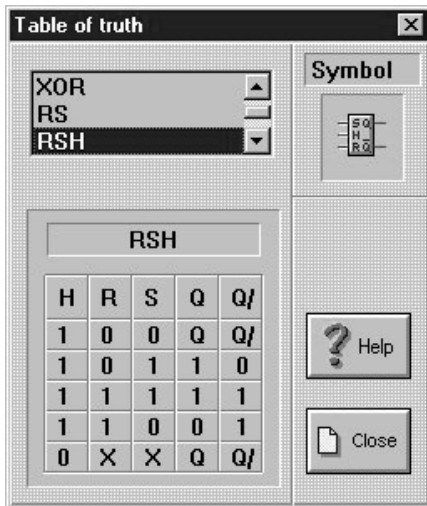
Simulation program

The 'pencil' tool allows you to connect logic gates. Only right angles are possible for the 'wires'. To use the pencil, pick it from the Tools bar, and left-click on an input or output of a logic operator. Next, move the mouse to the operator you want to connect up, and then release the mouse button.

The 'Copy' utility of Simulat also supports the use of the Clipboard to cut, copy, delete and paste elements in your circuit diagram.

Simulat has deletion utilities: for logic operators, connections and junctions. To delete an object, select the corresponding utility from the Tool bar.

The schematic may be spiced up a bit by text with or without a frame. It is possible to choose fonts, colours and character sizes, as well as text orientation (vertical or horizontal). The user may choose the frame colour, shade



and the frame type. Frame size is automatically adjusted to the amount of text and character height selected by the user.

It is possible to write up some comment with each schematic. The length of the comment text is limited to 50 characters.

Tools

The panoply of utilities found in the working subdirectory is complemented by a powerful 'special logic' calculator which is capable of performing special functions like number conversions and shift-right /shift-left opera-



tions. Using binary number notation, the range of operands is adjustable from eight bits to double 32-bit words. In addition, a truth table is available to help you remember the function of the main logic operators. This useful little tool pops up on the screen if you select the corresponding command. A simple mouse click on one of the logic operator types in the scroll list instantly displays the associated truth table and the corresponding logic symbol.

Circuit simulation

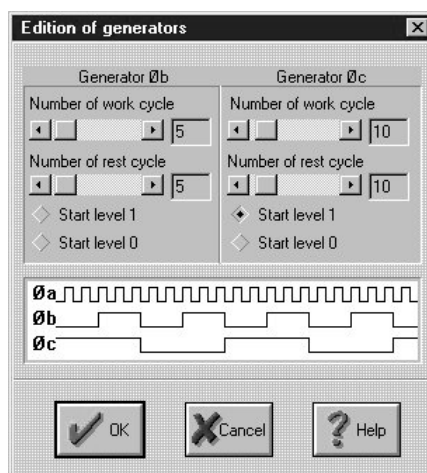
Having drawn and saved your schematic, you are ready to launch the circuit simulator. The program will

test all connections and display its findings as the test progresses. Any error encountered in this process, is made known to you by means of dialogue boxes. If Simulat does not encounter errors, it is possible to operate the virtual switches, indicator lamps, displays and thumbwheel switches, and so set up and manipulate various conditions to which the virtual logic circuit responds.

The links in the circuit diagram are shown in different colours depending on their logic level. You can read the logic level of an operator by left-clicking on the operator input or output. The cursor will then change to a symbol indicating 'zero' or 'one'.

Simulat 2.0 also comes with a logic oscilloscope capable of displaying up to five signals taken from points you indicate in the circuit diagram. The oscilloscope is 'triggered' by either a rising or a falling pulse edge detected on one of the five input channels. If the oscilloscope trace is not stable, you may insert a trigger delay to keep this virtual instrument synchronized.

Oscilloscope traces may be copied onto the Clipboard, or saved in a file. Furthermore, scope traces may be sent to the printer to produce hard copy, at a scaling factor you select. Alternatively, Simulat can compute the scale value needed to adapt the size of the drawing to that of the paper in the printer.

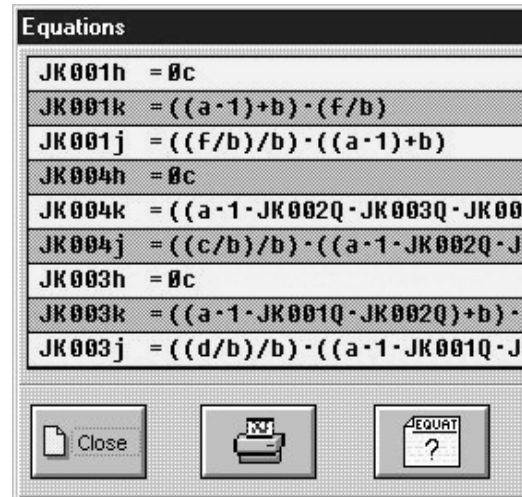


Logic equations

Simulat allows you to determine logic equations based on a schematic.

The calculation box identified as 'Equations' allows you to print equations that belong with a circuit diagram, using a number of options (line spacing, separation, page number,

etc.). Equations may be saved on the Clipboard or in a file on your disk. It is also possible to compute a partial equation. To do so, you click on the corresponding button shown by the dialogue box. Simulat then temporarily closes the box to enable you to click on the desired logic gate. Once that is



done, the dialogue box pops up again on the screen, showing the logic equation against a red background.

Library

Circuit elements may be saved in order to build a library of basic building blocks.

To do so, you choose the option 'Copy' and then limit the selection to the desired elements by means of a dashed box. Next, you actuate the command 'save model to disk' which may be found in the menu called 'Library'.

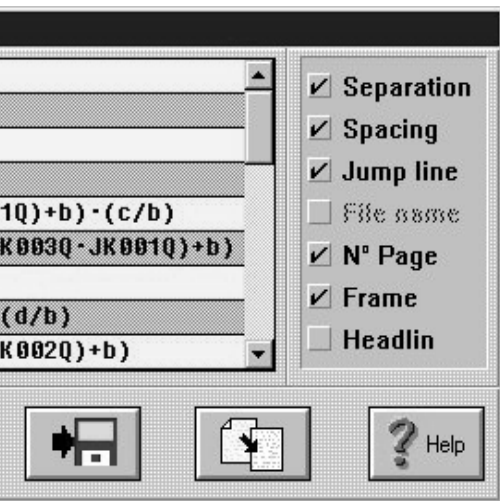
Finally, you may select the command 'Load model from memory'. This causes a certain element to be retrieved from the library and placed at the desired location in the current window.

Utilities & button palettes

The palettes (bars) containing utilities and buttons allow you to change the appearance of the program on the PC screen. Modifying the utilities palette allows you to increase the actually visible area in the window containing the schematic you are working on. In this way, you will be able to see more of your schematic. These palettes may be moved around to any location you want on the screen. Furthermore, the palettes and toolbars may be 'hidden' to create even more space on the screen.

Printing

Simulat 2.0 can provide a Print Preview. This dialogue box allows you to select the printable area, the scale, page margins, contents of the ID box, and other printer configurations,



before the print job is started.

The buttons in the dialogue box are 'repeat' types, allowing the relevant command to be issued again by keeping the cursor on the button representing the desired command.

Compatibility is assured with any printer already functioning in graphics mode, and driven by other applications running under Windows.

To print an ID box with the schematic, click on the button 'Cartouche'. A dialogue box pops up which allows you to define the text fields which are to appear in the ID box.

Paper margins may be set in the dialogue box 'Page Setup' ('Mise en Page'). In the title bar the program displays the paper dimensions and the printable area. These two values will of course depend on the printer you have connected up to your PC.

Help system

A powerful, context-sensitive help system is available.

To get help, you click on the 'Contextual Help' symbol in the button bar. Next, you click your way through the Help menu to get to the item you need help on.

File management

The file management system allows you to stay organized as far as your schematics are concerned.

The system offers you a number of pos-

sibilities for copying, moving, loading, opening and deleting your schematics. It also supports displaying file properties of disk drives, and free space on the hard disk.

Miscellaneous matters

Because Simulat 2.0 runs under the Windows 95 operating system, you are able to copy complete screens into the Clipboard, and from there move them to other applications like MS Write, etc., in order to create documents (useful for educational/didactic purposes).

Simulat 2.0 supports the Multiple Document (MD) system. The program allows you to work on four circuit diagrams simultaneously. The names of the schematics are displayed in the 'Window' menu ('Fenetre'). You can change between circuit diagrams in three ways:

- by left-clicking anywhere in the window of the schematic to be activated;
- by clicking on the name of the schematic as listed in the 'Window' menu;
- by selecting the 'Next' option from the System menu in a window.

Simulat 2.0 also supports the OLE 2.0 system. The linking and embedding functions allow Simulat 2.0 to accept different data types and objects produced with other programs. The main difference between *linking* an object and *embedding* it concerns the way in which data is stored: embedded objects form part of a schematic (i.e.,

they are integrated into the file), while linked objects remain stored in the original (source) file. The schematic then only keeps information relating to the location of the object in the source file.

Circuit diagram files may be selected and moved into the simulation window. Using the file management system you may pick one or more schematics and drop them in the simulation window. Once the cursor is on the program window, release the mouse button, and the selected files are loaded into the simulator. Note that Simulat 2.0 can only handle four schematics at a time.

System requirements

You will need to have Windows 95 installed (or a later version). The PC should have a 386 processor or better, 4 Mbytes of RAM, a VGA card and a mouse. Simulat 2.0 requires about 6 Mbytes of free space on your hard disk.

Note: The version described here supports a maximum of 100 components. The author can supply a larger version.

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